Summary of Last Lecture

- Decomposition
- Functional Dependency
- Functional dependency closure (F+)
  Direct and Indirect (logically implied)
- Attribute Set Closure (X+)

Dependencies

Full Functional Dependency

Given a relation schema R and an FD $x \rightarrow y$,

y is fully functionally dependent on x

if there is no z,

where z is proper subset of x

such that $z \rightarrow y$

Eg – $F = \{ ab \rightarrow c , b \rightarrow c \}$ where ab is CK

As c is depend on subset b

So c is not fully functionally dependent on ab

Dependencies

Partial Dependency

Given an relation R with the functional dependencies F defines on the attributes of R and

K as a candidate key,

if X is a proper subset of K and if F |= X → A ,

then A is said to be partially dependent on K.

Eg – F = { ab → c , b → c }

If ab is candidate key

Then as c is depend on subset b

So c is partially dependent on b

Dependencies

Transitive Dependency

Given a relation schema R with Fds F
defines on the attributes X, Y, and A.
If the set of Fds contains $X \rightarrow Y$ and $Y \rightarrow A$
then we can say that $X \rightarrow Y \rightarrow A$
so attribute A is transitively dependent on X.

Example

R={ name, course, grade, ph_no, major, course_dept}

F = { course → course_dept
name → ph_no,
name → major,
name, course → grade }

Candidate Key – name,course

Find Full functional dependency and partial functional dependency?

First Normal Form (1NF)

A relation is in First Normal Form if and only if the domain of each attribute contains only atomic (indivisible) values, and the value of each attribute contains only a single value from that domain.

OR

- An attribute (column) of a table cannot hold multiple values.
- It should hold only atomic values.

First Normal Form (1NF)

Example: Suppose a company wants to store the names and contact details of its employees.

emp_id	emp_name	emp_address	emp_mobile
101	Herschel	New Delhi	8912312390
102	Jon	Kanpur	8812121212 9900012222
103	Ron	Chennai	7778881212
104	Lester	Bangalore	9990000123 8123450987

This table is **not in 1NF** as the rule says "each attribute of a table must have atomic (single) values", the emp_mobile values for employees Jon & Lester violates that rule.

First Normal Form (1NF)

emp_id	emp_name	emp_address	emp_mobile
101	Herschel	New Delhi	8912312390
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104	Lester	Bangalore	8123450987

Note: Using the **First Normal Form**, data redundancy increases, as there will be many columns with same data in multiple rows but each row as a whole will be unique.

Second Normal Form (2NF)

- A table is said to be in 2NF if the following conditions hold:
  - Table is in 1NF (First normal form)
  - No Partial Dependency
  - Every non-prime attribute should be functionally dependent on prime attribute.
- An attribute that is not part of any candidate key is known as non-prime attribute.

Second Normal Form (2NF) Cont..

Consider relation

R = {stu_name, course, ph_no, dept, grade }

F = { stu_name,course → grade,
stu_name → ph_no,
stu_name → dept }

Primary Key – stu_name,course

Is above relation in 2NF?

Second Normal Form (2NF) Cont..

R = {stu_name, course, ph_no, dept, grade }

Decompose using functional dependencies

such that all functional dependencies preserve.

R1 = {stu_name, ph_no, dept }

R2 = {stu_name, course, grade }

Second Normal Form (2NF) Cont..

R={manufacturer, model, model_name, manu_country}

F = {manufacturer, model → model_name,
manufacturer → manu_country }

Key = {manufacturer, model}

Is in 2NF?

Decompose -

R1 = {manufacturer, model, model_name}

R2 = {manufacturer, manu_country}